

Date: Thursday, 06/11/2008 2:31:39 PM  
 User: Julie Dawson

## Process Sheet

Customer : CU-DAR001 Dart Helicopters Services	Drawing Name : OUTER FWD SADDLE
Job Number : 43246	
Estimate Number : 11076	
P.O. Number :	Part Number : D5951
This Issue : 06/11/2008 S.O. No. :	Drawing Number : D5951 REV.B
Prsht Rev. : NC	Project Number : N/A
First Issue : / / Type : MACHINED PARTS	Drawing Revision : B
Previous Run : 39793	Material :
Written By :	Due Date : 27/11/2008 Qty: 8 Um: Each
Checked & Approved By : <u>JLD 08-11-06</u>	
Comment : Est Rev:E Re-Format 05-11-29 JLM	
Est Rev:E Re-Format 05-11-29 JLM	

## Additional Product

Job Number:



Seq. #:	Machine Or Operation:	Description :
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1.0	D6101013	Saddle Billet
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Comment: Qty.: 1.0000 Each(s)/Unit Total : 8.0000 Each(s)  
 D6101-013 (7075-T7351)  
 Size 2.50" x 10.10" X 8.25" (Grain along 10.10")  
 Batch: B 41963

JLD 08/11/09

9

2.0	HAAS3	HAAS CNC VERTICAL MACHINING #3
-----	-------	--------------------------------



Comment: HAAS CNC VERTICAL MACHINING #3

1-Machine as per folio D5951, Ensure Batch Number is entered

2-Machine Keyway

3-Deburr & Tumble

JLD 08/11/09

9

PTO

3.0	QC1	INSPECT ALL DIM TO DIM SHEET
-----	-----	------------------------------



Comment: INSPECT ALL DIM TO DIM SHEET

JLD 08/11/09

9

4.0	QC8	SECOND CHECK
-----	-----	--------------



Comment: SECOND CHECK

SE 08/11/09

5.0	HAND FINISHING1	HAND FINISHING RESOURCE #1
-----	-----------------	----------------------------



Comment: HAND FINISHING RESOURCE #1  
 Chemical Conversion Coat as per QSI 005 4.1

M-J 08/11/17

9X

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: D5951 PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes ☐ No ☒ DQA: ll Date: 08-11-17  
 Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

NCR: <u>43246</u>		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			
<u>08/11/09</u>	<u>2.0</u>	<u>1 part, the flange thickness too small of .030"</u> <u>R.C. the tool come out from the holder.</u>	<u>GP</u> <u>08.11.10</u> <u>pc</u> <u>QSI 042</u>	<u>Margins still positive.</u> <u>SEE ATTACHED SR.</u> <u>Acceptable</u>	<u>[Signature]</u> <u>08/11/17</u>	<u>[Signature]</u> <u>08/11/16</u>	<u>GP</u> <u>08.11.10</u> <u>pc</u> <u>QSI 042</u>	<u>[Signature]</u> <u>08/11/17</u>

NOTE: Date & initial all entries

Date: Thursday, 06/11/2008 2:31:39 PM  
User: Julie Dawson

## Process Sheet

Customer: CU-DAR001 Dart Helicopters Services

Drawing Name: OUTER FWD SADDLE

Job Number: 43246

Part Number: D5951

Job Number:



Seq. #:

Machine Or Operation:

Description :

6.0

POWDER COATING

POWDER COATING



M109152



(9x)

Comment: POWDER COATING

Powder Coat White Gloss (Ref: 4.3.5.1) as per QSI 005 4.3

START TIME:

OVEN TEMPERATURE:

FINISH TIME:

1:45  
320  
2:15

MF 08/11/17

7.0

QC3

INSPECT POWDER COAT/CHEMICAL CONVERSION



jd



(9A)

Comment: INSPECT POWDER COAT/CHEMICAL CONVERSION

08-11-17

8.0

PACKAGING 1

PACKAGING RESOURCE #1



Comment: PACKAGING RESOURCE #1

Identify and Stock

Location:

ST430

18 08/11/18 (X9)

9.0

QC21

FINAL INSPECTION/W/O RELEASE



08/11/18

Comment: FINAL INSPECTION/W/O RELEASE

Job Completion



MF 08-11-18

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

**NOTE:** Date & initial all entries

<b>DART AEROSPACE LTD</b>		<b>Work Order:</b> 43246
<b>Description:</b> Outer Fwd Saddle		<b>Part Number:</b> D5951
<b>Inspection Dwg:</b> D5951	<b>Rev:</b> B	<b>Page 1 of 1</b>

Inspect dimensions highlighted on inspection sheet drawing and record below:

Dim	Min	Max	Go/No Go Gauge	Recorded Actual Dimensions				By	Date
				1	2	3	4		
A	0.437	0.444		.440	.440	.440	.440		
B	1.745	1.755		1.750	1.750	1.750	1.750		
C	5.245	5.255		5.250	5.250	5.250	5.250		
D	6.995	7.005		7.000	7.000	7.000	7.000		
E	5.240	5.260		5.247	5.250	5.249	5.249		
F	4.745	4.755		4.746	4.746	4.749	4.746		
G	0.315	0.322		.321	.321	.321	.321		
H	1.522	1.532		1.527	1.526	1.524	1.525		
I	3.048	3.058		3.055	3.054	3.052	3.052		
J	4.575	4.585		4.580	4.580	4.579	4.579		
K	0.315	0.322		.316	.321	.321	.321		
L	0.495	0.505		.497	.497	.498	.498		
M	0.490	0.510		.498	.498	.497	.498		
N	1.615	1.635		1.627	1.630	1.627	1.631		
O	7.990	8.010		8.000	8.000	8.000	8.000		
P	2.240	2.260		2.252	2.251	2.253	2.249		
Q	0.307	0.312		.310	.310	.310	.310		
R	0.760	0.765		.760	.760	.760	.760		
S	0.490	0.510		.500	.502	.502	.502		
T	1.375	1.395		1.381	1.380	1.381	1.381		
U	2.000	2.020		2.002	2.001	2.003	2.003		
V									
W									
X									
Y									
Z									
AA									
AB									
AC									
AD									
AE									
AF									
AG									
AH									
Accept/Reject									

Measured by: <i>One</i>
Date: 02/11/09

Audited by: <i>RF</i>
Date: 08/11/16

Rev	Date	Change	Revised by	Approved
A	99.04.19	New Issue	RF	
B	02.12.13	Reformat; Added Dim. T-U & DT8682, DT8686	KJ/RF	
C	06.12.06	Dimensions A,G,K,L,N,P revised	KJ/EC	
D	07.06.15	Dimension G revised	KJ/JLM	
E	08.04.21	Dimension E revised	KJ/DD	

<b>DART AEROSPACE LTD</b>		<b>Work Order:</b> <u>W3246</u>	
<b>Description:</b> Outer Fwd Saddle		<b>Part Number:</b> D5951	
<b>Inspection Dwg:</b> D5951		<b>Rev:</b> B	
		<b>Page 1 of 1</b>	

Inspect dimensions highlighted on inspection sheet drawing and record below:

				Recorded Actual Dimensions				By	Date
Dim	Min	Max	Go/No Go Gauge	#5	#6	#7	#8		
A	0.437	0.444		.440	.440	.440	.440		
B	1.745	1.755		1.750	1.750	1.750	1.750		
C	5.245	5.255		5.250	5.250	5.250	5.250		
D	6.995	7.005		7.000	7.000	7.000	7.000		
E	5.240	5.260		5.250	5.250	5.248	5.248		
F	4.745	4.755		4.745	4.748	4.748	4.746		
G	0.315	0.322		.321	.321	.321	.321		
H	1.522	1.532		1.527	1.524	1.525	1.527		
I	3.048	3.058		3.050	3.057	3.052	3.054		
J	4.575	4.585		4.580	4.580	4.579	4.580		
K	0.315	0.322		.321	.321	.321	.321		
L	0.495	0.505		.498	.498	.498	.499		
M	0.490	0.510		.497	.493	.492	.496		
N	1.615	1.635		1.630	1.630	1.630	1.629		
O	7.990	8.010		8.000	8.000	8.000	8.000		
P	2.240	2.260		2.248	2.248	2.251	2.249		
Q	0.307	0.312		.310	.310	.310	.310		
R	0.760	0.765		.760	.760	.760	.760		
S	0.490	0.510		.503	.503	.509	.502		
T	1.375	1.395		1.380	1.377	1.383	1.385		
U	2.000	2.020		2.002	2.001	2.005	2.007		
V									
W									
X									
Y									
Z									
AA									
AB									
AC									
AD									
AE									
AF									
AG									
AH									
Accept/Reject									

Measured by:	<u>ML</u>
Date:	<u>08/11/09</u>

Audited by:	<u>SS</u>
Date:	<u>08/11/16</u>

Rev	Date	Change	Revised by	Approved
A	99.04.19	New Issue	RF	
B	02.12.13	Reformat; Added Dim. T-U & DT8682, DT8686	KJ/RF	
C	06.12.06	Dimensions A,G,K,L,N,P revised	KJ/EC	
D	07.06.15	Dimension G revised	KJ/JLM	
E	08.04.21	Dimension E revised	KJ/DD	

<b>DART AEROSPACE LTD</b>		<b>Work Order:</b> 43246
<b>Description:</b> Outer Fwd Saddle		<b>Part Number:</b> D5951
<b>Inspection Dwg:</b> D5951	<b>Rev:</b> B	<b>Page 1 of 1</b>

Inspect dimensions highlighted on inspection sheet drawing and record below:

				Recorded Actual Dimensions					
Dim	Min	Max	Go/No Go Gauge	1	2	3	4	By	Date
A	0.437	0.444		.440					
B	1.745	1.755		1.750					
C	5.245	5.255		5.250					
D	6.995	7.005		7.000					
E	5.240	5.260		5.250					
F	4.745	4.755		4.748					
G	0.315	0.322		.321					
H	1.522	1.532		1.528					
I	3.048	3.058		3.054					
J	4.575	4.585		4.579					
K	0.315	0.322		.321					
L	0.495	0.505		.499					
M	0.490	0.510		.469					
N	1.615	1.635		1.629					
O	7.990	8.010		7.999					
P	2.240	2.260		2.245					
Q	0.307	0.312		.310					
R	0.760	0.765		.760					
S	0.490	0.510		.501					
T	1.375	1.395		1.379					
U	2.000	2.020		2.005					
V									
W									
X									
Y									
Z									
AA									
AB									
AC									
AD									
AE									
AF									
AG									
AH									
Accept/Reject									

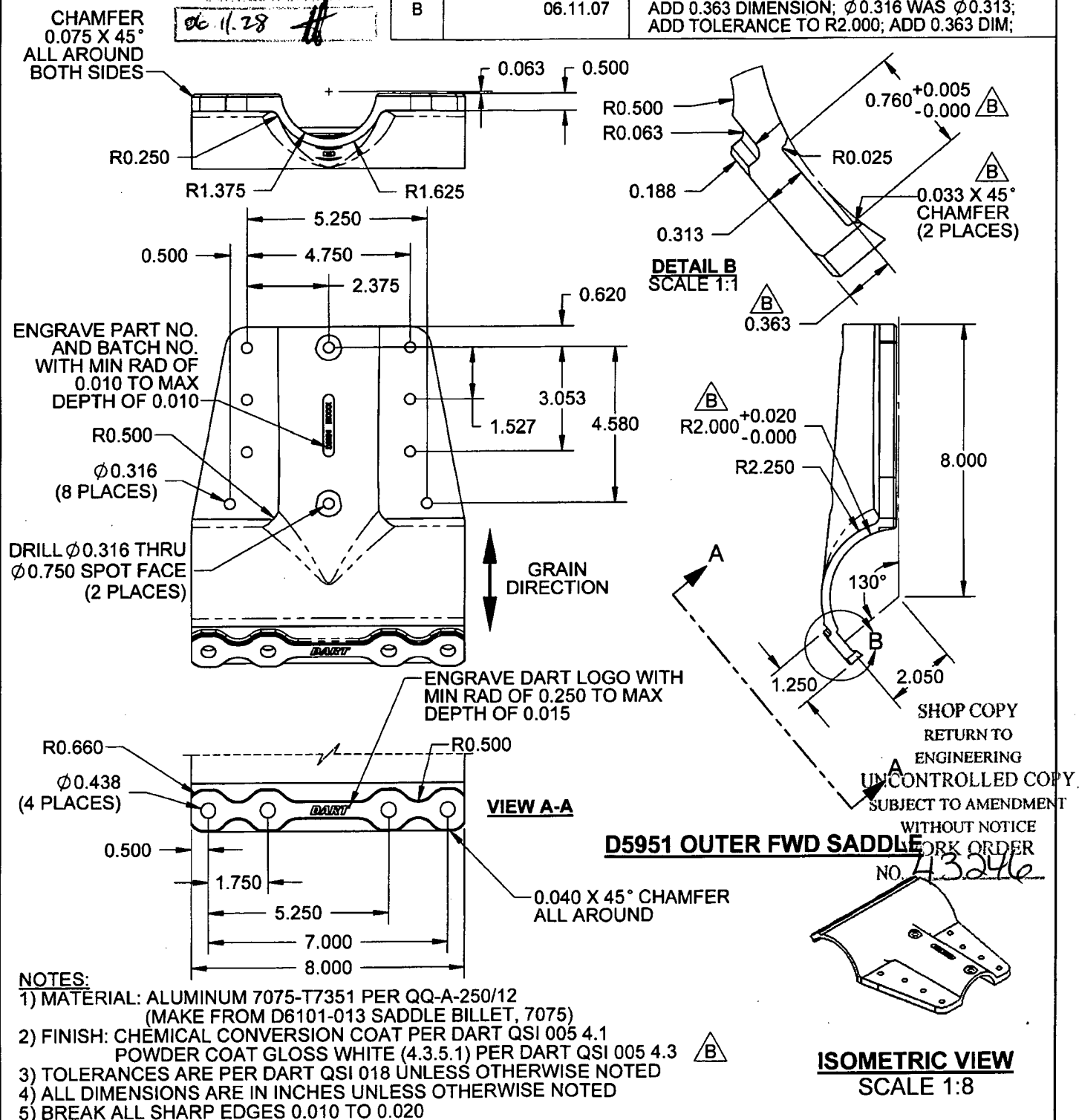
Measured by: <i>[Signature]</i>
Date: 08/11/10

Audited by: <i>[Signature]</i>
Date: 08/10/16

Rev	Date	Change	Revised by	Approved
A	99.04.19	New Issue	RF	
B	02.12.13	Reformat; Added Dim. T-U & DT8682, DT8686	KJ/RF	
C	06.12.06	Dimensions A,G,K,L,N,P revised	KJ/EC	
D	07.06.15	Dimension G revised	KJ/JLM	
E	08.04.21	Dimension E revised	KJ/DD	

**DART**

DESIGN <b>BW</b>	DRAWN BY <b>CB</b>	<b>DART AEROSPACE LTD</b> HAWKESBURY, ONTARIO, CANADA	
CHECKED <b>CE</b>	APPROVED <b>[Signature]</b>	DRAWING NO. <b>D5951</b>	REV. B SHEET 1 OF 1
DATE <b>06.11.07</b>	TITLE <b>OUTER FWD SADDLE</b>		SCALE 1:4
REV <b>A</b>	DATE <b>97.05.06</b>	DESCRIPTION <b>NEW ISSUE</b>	
<b>B</b>	<b>06.11.07</b>	INCORPORATE DEO 9102, DEO 9079; ADD 0.363 DIMENSION; $\phi 0.316$ WAS $\phi 0.313$ ; ADD TOLERANCE TO R2.000; ADD 0.363 DIM;	



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Excerpt from  
SR-D205-594-1

CP 08.11.10

## 5.0 Saddle Attachment Analysis

### 5.1 Saddle Attachment Geometry

Figure 1 in Reference 1 illustrates the geometry and co-ordinate system of the saddles and skidtube.

$L_{sad} := 8 \cdot \text{in}$	Saddle length
$t_{over} := 0.250 \cdot \text{in}$	Saddle overhang thickness
$D_f := 0.438 \cdot \text{in}$	Saddle flange bolt holes, diameter
$t_f := 0.313 \cdot \text{in}$	Saddle flange thickness
$w_f := 0.75 \cdot \text{in}$	Skidtube flange thickness
$e_f := 0.281 \cdot \text{in}$	Saddle flange edge distance
$D_x := 0.313 \cdot \text{in}$	Saddle-to-crosstube bolt holes, diameter
$e_x := 0.464 \cdot \text{in}$	Saddle edge distance near saddle-to-crosstube bolt holes
$t_r := 0.250 \cdot \text{in}$	Saddle thickness at saddle-to-crosstube interface
$t_{mat} := 0.470 \cdot \text{in}$ WAS 0.500	Saddle thickness at AN5 attachment flanges
$c_{tube} := 1.375 \cdot \text{in}$	Crosstube radius at cuff (portion in saddle)
$h_f := 6 \cdot \text{in}$	Crosstube bore height (portion in saddle)
$t_c := 0.375 \cdot \text{in}$	Thickness of crosstube wall
$c_y := 2.00 \cdot \text{in}$	Skidtube, vertical radius
$c_z := 2.05 \cdot \text{in}$	Skidtube, horizontal radius
$w_{all} := 0.100 \cdot \text{in}$	Skidtube wall thickness
$t_s := c_z - c_y + w_{all} \quad t_s = 0.15 \cdot \text{in}$	Skidtube minimum wall thickness at the location ridge
$n_t := 8$	Number of skidtube bolt shear areas
$n_s := 4$	Number of saddle quadrants
$n_c := 4$	Number of crosstube bolt shear areas
$n_f := 4$	Number of flange bolts each side of crosstube

### 5.2 Maximum Forces and Moments

In comparing the D5951/D5953/D5955/D5957 saddles used in D205-594-011 vs the D2571/D2572/D2573/D2574 saddles used in D205-634-011 (existing high gear skidtube approved per TC STC SH96-88 and FAA STC SR00563NY), the D5951/D5953/D5955/D5957 saddles have been significantly reinforced for the larger overturning moments. Because the D205-594-011 landing gear is softer than existing high-gears (such as the Dart D212-664-101/-201 crosstubes approved per TC STC SH01-9 and FAA STC SR01298NY), all other saddle loads generated by crosstube stiffness are less than for existing high-gear crosstubes (as verified by deflection testing per TP-D205-594-2). Therefore, this analysis determines whether the D5951/D5953/D5955/D5957 saddles are capable of sustaining the larger overturning moment created by FAR 29.501(c) and FAR 29.501(f1). To be conservative, the moment arms used in these calculations correspond to the undeflected heights of the crosstubes.

$M_f := (0.223 \cdot 2.92 \cdot 1722 \cdot \text{lb}) \cdot (42.00 \cdot \text{in})$	$M_f = 47094 \cdot \text{lb} \cdot \text{in}$	FAR 29.501(c) @ Forward Saddle
$M_a := (0.223 \cdot 2.37 \cdot 3915 \cdot \text{lb}) \cdot (40.00 \cdot \text{in})$	$M_a = 82765 \cdot \text{lb} \cdot \text{in}$	FAR 29.501(c) @ Aft Saddle
$GW := 11200 \cdot \text{lb}$	Gross weight of 212, which is most critical in Bell 204/205/212 series	
$F_{zsad} := \frac{1}{2} \cdot 1.33 \cdot GW \cdot \cos(45 \cdot \text{deg})$	$F_{zsad} = 5267 \cdot \text{lb}$	FAR 29.501(f1) Vertical Load
$F_{xsad} := \frac{1}{2} \cdot 1.33 \cdot GW \cdot \sin(45 \cdot \text{deg})$	$F_{xsad} = 5267 \cdot \text{lb}$	FAR 29.501(f1) Fwd Load
$M_{ysad} := F_{xsad} \cdot 42.00 \cdot \text{in} - F_{zsad} \cdot 4 \cdot \text{in}$	$M_{ysad} = 200128 \cdot \text{lb} \cdot \text{in}$	FAR 29.501(f1) @ Fwd Saddle
<b>Most Critical</b>		

### Saddle Material Strength

This calculation checks the strength of the saddle material through the critical cross section illustrated in Figure 4 of Reference 1. The estimates for the inertia values and the area of this cross section are also shown in the Reference section.

$$\begin{aligned} L_f &:= \frac{L_{\text{sad}}}{2} - \text{ctube} & L_f &= 2.63 \cdot \text{in} & \text{Flange length} \\ CG_x &:= \text{ctube} + 0.5 \cdot L_f & CG_x &= 2.69 \cdot \text{in} & \text{Center of Gravity of flange} \\ I_x &:= \frac{\pi}{4} \cdot [(\text{ctube} + \text{tr})^4 - \text{ctube}^4] + 4 \cdot \left( \frac{1}{12} \cdot t_{\text{mat}} \cdot L_f^3 + t_{\text{mat}} \cdot L_f \cdot CG_x^2 \right) & I_x &= 41.15 \cdot \text{in}^4 \\ A &:= \pi \cdot [(\text{ctube} + \text{tr})^2 - \text{ctube}^2] + 4 \cdot t_{\text{mat}} \cdot L_f & A &= 7.29 \cdot \text{in}^2 \end{aligned}$$

#### a) Stress due to Mysad and Fzsad

$$\begin{aligned} \sigma_z &:= \frac{M_{\text{ysad}} \cdot L_{\text{sad}}}{2 \cdot I_x} + \frac{F_{\text{zsad}}}{A} & \sigma_z &= 20177.4 \cdot \text{lb} \cdot \text{in}^{-2} & \text{Stress due to Mysad and Fzsad} \\ MS5a &:= \frac{F_{\text{cy}3}}{\sigma_z} - 1 & MS5a &= 1.68 & \text{Margin of Safety} \end{aligned}$$

#### b) Shear Stress due to Fxsad

$$\begin{aligned} \tau_{xy} &:= \frac{F_{\text{xsad}}}{A} & \tau_{xy} &= 722.31 \cdot \text{lb} \cdot \text{in}^{-2} & \text{Shear stress} \\ MS5b &:= \frac{F_{\text{su}3}}{\tau_{xy}} - 1 & MS5b &= 54.38 & \text{Margin of Safety} \end{aligned}$$

### 5.4 Margin of Safety Summary

MS1a = 0.99 Shear strength of saddle ridge, ultimate

MS1b = 2.49 Shear strength of saddle ridge, yield

MS2a = 12.09 Saddle-to-skidtube bolt strength

MS2b = 18.37 Saddle-to-skidtube bearing on saddle

MS2c = 9.69 Saddle-to-skidtube shear tear-out

MS2d = 7.18 Saddle-to-skidtube bearing on skidtube

MS3a = 2.09 Saddle-to-crosstube bolt strength

MS3b = 2.91 Saddle-to-crosstube bearing on saddle

MS3c = 3.98 Saddle-to-crosstube shear tear-out

MS3d = 4.80 Saddle-to-crosstube bearing on crosstube

MS4 = 0.93 Saddle splitting

MS5a = 1.68 Saddle stress due to Myrot and Fzrot

MS5b = 54.38 Saddle shear stress

## **6.0 Conclusion**

All margins are positive, therefore the saddle attachment for the D205-594-011 Extended Height Landing Gear meet the loading requirements of FAR 29.471/473/501/571. The drop weight for TP-D205-594-1 will be increased to 6320 lb, to account for the damage tolerance of ICA-D205-594 and the requirements of FAR 29.501(d2). The fatigue life of the crosstubes is sufficiently long to allow for an "on condition" replacement criteria in ICA-D205-594.

P 08.11.10

## 5.0 Saddle Attachment Analysis

### 5.1 Saddle Attachment Geometry

Figure 1 in Reference 1 illustrates the geometry and co-ordinate system of the saddles and skidtube.

Lsad := 8·in	Saddle length
tover := 0.250·in	Saddle overhang thickness
Df := 0.438·in	Saddle flange bolt holes, diameter
tf := 0.313·in	Saddle flange thickness
wf := 0.75·in	Skidtube flange thickness
ef := 0.281·in	Saddle flange edge distance
Dx := 0.313·in	Saddle-to-crosstube bolt holes, diameter
ex := 0.464·in	Saddle edge distance near saddle-to-crosstube bolt holes
tr := 0.250·in	Saddle thickness at saddle-to-crosstube interface
tmat := 0.470·in WAS 0.500	Saddle thickness at AN5 attachment flanges
ctube := 1.375·in	Crosstube radius at cuff (portion in saddle)
hf := 6·in	Crosstube bore height (portion in saddle)
tc := 0.375·in	Thickness of crosstube wall
cy := 2.00·in	Skidtube, vertical radius
cz := 2.05·in	Skidtube, horizontal radius
wall := 0.100·in	Skidtube wall thickness
ts := cz - cy + wall ts = 0.15·in	Skidtube minimum wall thickness at the location ridge
nt := 8	Number of skidtube bolt shear areas
ns := 4	Number of saddle quadrants
nc := 4	Number of crosstube bolt shear areas
nf := 4	Number of flange bolts each side of crosstube

### 5.2 Maximum Forces and Moments

In comparing the D5951/D5953/D5955/D5957 saddles used in D205-594-013/-023 vs the D2571/D2572/D2573/D2574 saddles used in D205-634-011 (existing low gear skidtube approved per TC STC SH96-88 and FAA STC SR00563NY), the D5951/D5953/D5955/D5957 saddles have been significantly reinforced for the larger overturning moments. Because the D205-594-013/-023 landing gear is softer than existing Bell low gear, all other saddle loads generated by crosstube stiffness are less than for existing high-gear crosstubes (as verified by deflection testing per TP-D205-594-5). Therefore, this analysis determines whether the D5951/D5953/D5955/D5957 saddles are capable of sustaining the larger overturning moment created by FAR 29.501(c) and FAR 29.501(f1). To be conservative, the moment arms used in these calculations correspond to the undeflected heights of the crosstubes.

Mf := (0.223·3.20·1855·lb)·(36.100·in) Mf = 47787·lb·in	FAR 29.501(c) @ Forward Saddle
Ma := (0.223·2.43·4405·lb)·(33.40·in) Ma = 79727·lb·in	FAR 29.501(c) @ Aft Saddle
GW := 11200·lb	Gross weight of 212, which is most critical in Bell 204/205/212 series
Fzsad := $\frac{1}{2} \cdot 1.33 \cdot GW \cdot \cos(45 \cdot \text{deg})$ Fzsad = 5267·lb	FAR 29.501(f1) Vertical Load
Fxsad := $\frac{1}{2} \cdot 1.33 \cdot GW \cdot \sin(45 \cdot \text{deg})$ Fxsad = 5267·lb	FAR 29.501(f1) Fwd Load
Mysad := Fxsad·36.10·in - Fzsad·4·in Mysad = 169056·lb·in	FAR 29.501(f1) @ Fwd Saddle
<b>Most Critical</b>	

### Saddle Material Strength

This calculation checks the strength of the saddle material through the critical cross section illustrated in Figure 4 of Reference 1. The estimates for the inertia values and the area of this cross section are also shown in the Reference section.

$$L_f := \frac{L_{sad}}{2} - ctube$$

$$L_f = 2.63 \cdot \text{in}$$

Flange length

$$CG_x := ctube + 0.5 \cdot L_f$$

$$CG_x = 2.69 \cdot \text{in}$$

Center of Gravity of flange

$$I_x := \frac{\pi}{4} \cdot [(ctube + tr)^4 - ctube^4] + 4 \cdot \left( \frac{1}{12} \cdot tmat \cdot L_f^3 + tmat \cdot L_f \cdot CG_x^2 \right)$$

$$I_x = 41.15 \cdot \text{in}^4$$

$$A := \pi \cdot [(ctube + tr)^2 - ctube^2] + 4 \cdot tmat \cdot L_f$$

$$A = 7.29 \cdot \text{in}^2$$

#### a) Stress due to Mysad and Fzsad

$$\sigma_z := \frac{Mysad \cdot L_{sad}}{2 \cdot I_x} + \frac{Fzsad}{A}$$

$$\sigma_z = 17156.74 \cdot \text{lb} \cdot \text{in}^{-2}$$

Stress due to Mysad and Fzsad

$$MS5a := \frac{Fcy3}{\sigma_z} - 1$$

$$MS5a = 2.15$$

Margin of Safety

#### b) Shear Stress due to Fxsad

$$\tau_{xy} := \frac{Fxsad}{A}$$

$$\tau_{xy} = 722.31 \cdot \text{lb} \cdot \text{in}^{-2}$$

Shear stress

$$MS5b := \frac{Fsu3}{\tau_{xy}} - 1$$

$$MS5b = 54.38$$

Margin of Safety

### 5.4 Margin of Safety Summary

MS1a = 1.33 Shear strength of saddle ridge, ultimate

MS1b = 3.09 Shear strength of saddle ridge, yield

MS2a = 12.09 Saddle-to-skidtube bolt strength

MS2b = 18.37 Saddle-to-skidtube bearing on saddle

MS2c = 9.69 Saddle-to-skidtube shear tear-out

MS2d = 7.18 Saddle-to-skidtube bearing on skidtube

MS3a = 2.09 Saddle-to-crosstube bolt strength

MS3b = 2.91 Saddle-to-crosstube bearing on saddle

MS3c = 3.98 Saddle-to-crosstube shear tear-out

MS3d = 4.80 Saddle-to-crosstube bearing on crosstube

MS4 = 1.28 Saddle splitting

MS5a = 2.15 Saddle stress due to Myrot and Fzrot

MS5b = 54.38 Saddle shear stress

## **6.0 Conclusion**

All margins are positive, therefore the saddle attachment for the D205-594-013/-023 Extended Height Landing Gear meet the loading requirements of FAR 29.471/473/501/571. The drop weight for TP-D205-594-4 will be increased to 7036 lb, to account for the damage tolerance of ICA-D205-594 and the requirements of FAR 29.501(d2). The fatigue life of the crosstubes is sufficiently long to allow for an "on condition" replacement criteria in ICA-D205-594.